DEVELOPMENT MANAGEMENT TO REDUCE COASTAL STORM HAZARDS

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We have been doing research on the use of development management programs and policies to reduce life loss and damages in hurricanes and severe coastal storms. Little systematic data were found on how coastal localities address the hurricane and storm threat. To gain a greater understanding of the programs and policies in place in coastal localities, we surveyed high-hazard coastal communities in the Atlantic and Gulf Coast states.

The questionnaire we used addressed these issues:

1) What are the major characteristics of coastal development, and what factors influence these patterns?

2) What types of programs and measures (including development management) are coastal localities using to reduce hurricane and storm hazards?

3) How effective are these programs and measures at reducing storm hazards?

4) What are the major factors which affect the political feasibility and acceptability of hazard mitigation measures, particularly development management?

5) What are the factors which influence the effectiveness of mitigation programs and measures, particularly development management?

Coastal communities were surveyed if they had a population of 1000 or greater, and contained V-zones, or velocity zones, as designed under the National Flood Insurance Program (NFIP). Surveys were sent to over 600 localities in 18 states (Alabama, Connecticut, Delaware, Florida, Georgia, Louisiana, Maine, Maryland, Massachusets, Mississippi, New Hampshire, New Jersey, New York, North

Carolina, Rhode Island, South Carolina, Texas, and Virginia), with a 66% response rate.

The findings of the survey will be discussed with respect to what coastal localities are now using to mitigate the storm threat and to manage future development (for a more in-depth discussion see Beatley et al., 1985). Obstacles and arguments against the enactment of development management measures, and problems resulting from existing development management programs will be summarized and discussed with regard to the implications these have for planners, policy makers, and others concerned with the use of development management to mitigate severe coastal damages.

Survey Results

In aggregate, the surveyed communities displayed some general land use trends. Existing flood plain development within the hurricane-prone communities is predominantly single-family detached residential, while recent development in the coastal floodplains has shown increasing degrees of multi-family and commercial development (which includes recreational and motel/hotel). Many areas are significantly built out: in over one-third of the surveyed communities, hazard-free development sites--those outside of the 100-year floodplain--were considered scarce or very scarce.

The majority of survey respondents were at least somewhat familiar with state programs assisting localities in storm hazard management. Most had received some type of state assistance in the past five years, most frequently information on the NFIP and floodplain maps. One-half of the respondents indicated that their community had received assistance with disaster preparedness plans. In over one-half of the communities, a regional agency had been involved in storm hazard mitigation, most often in the preparation of a regional evacuation plan.

In addition, approximately 72% of the survey respondents indicated that their jurisdiction's governing body considered the threat of severe coastal storms to be at least a medium priority in the community, while almost half (46%) said that it was either a high or very high priority.

Techniques in Use

The survey asked about storm hazard reduction strategies and the use of programs to alter the coastal environment structurally, to strengthen buildings and facilities, and to manage development. The questions asked about the effectiveness of specific techniques or approaches in the respondent's locality

in reducing coastal storm hazards. Hazard-reducing programs were broken into three main categories: those that structurally alter the environment, those that strengthen buildings and facilities, and those that manage development. Programs that alter the coastal environment include shoreline protection and flood control works, and sand moving or trapping programs. These programs have widespread use, as shown in Table 1. Shoreline protection works, such as bulkheads and seawalls, were being used in more than two-thirds of the localities.

TABLE 1: Programs to Structurally Alter the Environment

Method	Number of communities using technique (percentage of total)	Average Effectiveness Rating (on a 5 point scale)
1. Shoreline Protection Works (bulkheads, seawalls, revetments)	289 (68.8%)	3.20
2. Flood Control Works (dikes, channels, retaining ponds)	142 (33.8%)	3.47
3. Sand Trapping Structures (groins, jetties)	141 (33.6%)	2.72
4. Sand Moving Programs (beach nourishment, beach scraping)	129 (30.7%)	2.77

Table 2 shows the use of programs to strengthen buildings and facilities. Almost all localities had adopted the minimum elevation and floodproofing required under the NFIP (93.8%), and most had adopted a building code (90%). Almost half of the localities (46%) were using additional storm-resistant standards for coastal construction. While more extensive elevation and floodproofing requirements were only used by approximately 15% of the localities, they had the highest effectiveness rating of the listed policies.

TABLE 2: Programs to Strengthen Buildings and Facilities

Method	Number of communities using technique (percentage of total)	Average Effectiveness Rating (on a 5 point scale)
1. Minimum elevation and flood-proofing required under the NFIP	394 (93.8%)	3.86
2. Building Code	378 (90.0)	3.6
3. Special Storm-Resistent Building Standards	198 (47.1)	3.82
4. Floodproofing of Public Facilities and Structures (sewer and water, roads, utilities)	161 (40.2)	3.47
5. More extensive elevation and flood-proofing than required by the NFIP	62 (14.8%)	3.94

The survey asked a number of questions regarding the use of development management in these jurisdictions. "Development Management" was defined to include programs or policies which control or influence the location, density, timing, and type of development in a jurisdiction. (See Brower et al., 1984 for a general discussion of development management; and McElyea, Brower, and Godschalk, 1982 for an application of these techniques to hazard mitigation.) Twenty-one different development management programs or policies were listed for communities to identify as in use in their localities. Most local governments are using a number of development management techniques: 29% indicated that between one and five techniques were being used, almost 55% were using six to ten measures, 15% had more than 11 development management measures in use.

Table 3 lists the 21 development management measures by their frequency of use by the surveyed localities, and indicates their average perceived effectiveness at reducing storm hazards. Over 80% of the localities had zoning ordinances, subdivision ordinances, and land use plans; however, these three techniques were not rated as particularly effective in reducing coastal storm hazards. Special hazard area ordinances, while only in use in 26% of the localities, received the highest overall effectiveness ranking of 3.85 (on a

TABLE 3: Development Management Measures by Order of Frequency Used

Rank Order	Type of Measure	Number of communities using technique (percentage of total)	Average Effectiveness Rating (on a 5 point scale)
1.	Zoning ordinance	368 (86.6%)	3.15
2.	Subdivision Ordinance	359 (85.5%)	3.06
3.	Comprehensive/Land Use Plan	352 (83.8%)	2.94
4.	Evacuation Plan	278 (66.2%)	3.54
5.	Shoreline setback regulation	225 (53.6%)	3.59
6.	Capital improvements program	222 (52.1%)	2.55
7.	Location of public structures and buildings to reduce storm risks	193 (46.0%)	3.66
8.	Dune Protection regulations	159 (37.9%)	3.68
9.	Location of capital facilities to reduce or discourage development in high hazard areas	131 (31.2%)	3.41
10.	Acquisition of undeveloped land in hazardous areas	121 (28.8%)	3.61
11.	Special hazard area ordinance	109 (26.0)	3.85
12.	Hazard disclosure requirements in real estate transactions	107 (25.5%)	2.92
13.	Transfer of development potential from hazardous to non-hazardous sites	89 (21.2%)	3.44
14.	Recovery/reconstruction plan or policies	88 (21.0%)	2.99
15.	Hurricane/storm component of comprehensive plan	81 (19.3%)	3.34
16.	Construction practice seminars	65 (15.5%)	3.22
17.	Acquisition of development rights or scenic easements	58 (13.8%)	2.88
18.	Reduced or below market taxation	45 (10.7%)	3.02
19.	Acquisition of damaged buildings in hazardous areas	14 (3.3%)	3.3
20.	Building relocation program	9 (2.1%)	3.33
21.	Impact taxes or special assessments	8 (1.9%)	3.75

scale of 1 to 5). Impact taxes or special assessments were also considered highly effective in reducing coastal storm hazards (a 3.75 effectiveness ranking), yet less than 2% of the localities have such programs. Dune protection regulations were considered the third most effective measure, and 38% of the localities have such regulations.

The survey also attempted to obtain insights into factors which influence the political feasibility of development management. Respondents identified what they perceived as obstacles in their community to the enactment of development management. These are listed in Table 4 by order of frequency.

TABLE 4: Obstacles to the Enactment of Development Management

Attitude	Number of Communities with Attitude (percentage of total)	Importance Rating (on a 5 point scale)
1. General conservative attitude toward government control of private property rights.	327 (87.7%)	3.35
2. General feeling that the community can "weather the storm"	317 (85.4)	3.07
3. Lack of adequate financial resources to implement mitigation programs	304 (84.4%)	3.41
4. More pressing local problems and concerns	300 (82.2%)	3.26
5. Lack of trained personnel to develop mitigation programs	287 (80.2%)	2.91
6. Lack of incentives or requirements from higher levels of government	286 (79.9%)	3.00
7. Opposition of real estate and development interests	294 (79.7%)	3.03
8. Opposition of homeowners	260 (73.9%)	2.63
9. Opposition of business interests	248 (70.7%)	2.59
10. Absence of politically-active individuals and groups advocating hurricane/storm mitigation	248 (70.7%)	2.82
11. Inadequate or inaccurate federal flood insurance maps	221 (62.3%)	2.48

The four obstacles cited by more than 80% of the responding localities were considered the top four in importance or severity: 1) the general conservative attitude toward government control of private property rights, 2) a general feeling that the community can "weather the storm," 3) lack of adequate financial resources to implement mitigation programs, and 4) more pressing local concerns.

Respondents also indicated the existence and importance in their localities of several popular arguments against development management. Almost 85% of the responding communities indicated that an important argument used in their community against the enactment of development management was that such measures lead to increased development costs. Other arguments cited by communities as important were: decisions about risks from coastal storms are best left to the individual (71%), development management measures will dampen the local economy (68.5%), and particular development management measures are illegal or unconstitutional (66%).

Regarding development management programs already in place, almost half (49%) of the respondents indicated that they had encountered implementation or enforcement problems. The most frequently cited problem was insufficient funds, mentioned by 60% of the responding localities. In addition, 46% noted problems due to public opposition, 43% cited a lack of support by public officials, and 41% noted that lack of qualified personnel was a problem. Other problems less frequently cited were an insufficient data base, opposition from developers, and public apathy. In addition, approximately one-third of the respondents perceived that their localities had experienced negative consequences as a result of development management programs. The great majority of these affected communities cited an increase in construction costs (84%), while much smaller percentages indicated that they had experienced slowed economic growth and development (20%), reduced tax revenues (15%), or reduced land values (11%).

Implications for Planning

Some important trends and relationships have emerged from these preliminary survey results which can provide insights for those concerned with hazard mitigation and the reduction of coastal flood hazards. Lack of adequate financial resources is cited as the greatest obstacle to development management--both in enacting measures, and in enforcing and implementing existing measures. Coastal communities frequently have limited administrative and financial capac-

ities, and may not be able to afford expensive land use or management studies. Historically, funds have been accessible for structural flood control studies and projects, while difficult to procure for non-structural hazard mitigation measures (Kusler, 1982, p. 71; David, 1984, p. 32). Structural measures have become increasingly cost-prohibitive to construct, expensive to maintain over time, and are often ineffective in reducing long-term coastal hazards. More permanent and cost-effective hazard mitigation solutions may be achieved at the local level through development management, but this will likely require financial support from state or federal sources.

Because of their financial limitations, many coastal communities cannot afford full-time planning staff, and where staffs exist, they may have limited technical capabilities. Further analyses of the survey data showed that the adoption of explicit hazard reduction strategies and development management measures were positively linked with both the community's population size, and number of planning personnel. Not surprisingly, communities with explicit hazard mitigation policies were linked with regional agencies active in storm hazard mitigation, and effectiveness of a community's development management program increased with the respondent's increasing knowledge of sources of state assistance. These illustrate the important role that state and regional agencies can play in assisting local communities with adopting hazard mitigation and development management measures. Outside technical assistance and expertise will also help local decision makers to consider hazard mitigation and development management measures with which they may be unfamiliar or inexperienced.

Political opposition, lack of interest, and more pressing local problems also appeared to created substantial impediments to enacting development management measures. State and federal regulations that require communities to address coastal storm threats through development management and other nonstructural mitigation techniques help deflect public opposition away from local officials. In addition, it is widely perceived that development management measures may dampen the local economy and increase development costs; communities may be hesitant to enact measures because they perceive that they may become economically less competitive with other communities. Requirements from the state or federal level for such measures would eliminate this, while ensuring that all communities address at least a minimum of nonstructural hazard mitigation efforts. For instance, the North Carolina coastal management pro-

gram requires local land use plans for all coastal communities, and has recently passed a requirement that all communities address hazard mitigation and postdisaster reconstruction planning.

Strengthening state and federal support for development management will help to overcome obstacles and implementation problems, but to achieve successful and effective local programs, planners and policy makers need to address and diffuse the popular arguments and attitudes against development management. Some of these arguments may be based more on perceptions than experience-- over 300 surveyed communities indicated that an argument against development management in their community was that increased developmental costs resulted from development management, but only one-third of this number had seen any such increase. Similarly, while "development management measures dampen the local economy" was an attitude existing in a great number of surveyed communities, very few actually perceived that their community had experienced slowed economic growth and development as a result of such measures.

Where measures have led to an increase in development costs, these can usually be explained as a shift of the additional costs required by coastal development from the community and public at large onto those who directly benefit from such development--the private developers and individual purchasers of hazardous development. Supporters of positions that advocate the rights of individual decisions regarding coastal development and risk-taking will have trouble justifying the use of public expenditures to help pay for the additional costs imposed by such development.

Advocates of development management need to emphasize other public issues affected by coastal development. The quality of public beach fronts can be deleteriously affected by unwise coastal development. Because of the public safety issues posed by hurricanes and severe coastal storms, the ultimate land use pattern and intensity of an area should not be created solely by private decisions regarding individual risks. The need for an adequate evacuation capacity, and the damage potential to neighboring properties created by storm-swept debris from hazardous construction highlight two of the unique public safety issues that are present in coastal development. Planners and policy makers need to emphasize such public safety issues to help overcome conservative attitudes toward private property regulation.

Finally, it is important for proponents of development management to fit hazard mitigation objectives into existing community goals and policies. The

survey results indicated a relatively high degree of local concern over the hurricane and severe coastal storm threat, but were less conclusive on the effectiveness of localities' attempts to address this concern through development management techniques. In many areas, local policy makers may simply be unfamiliar with the concept of reducing hurricane hazards through development management measures, addressing the threat by relying instead on strengthening and reinforcing the built environment, or by increasing evacuation capacity.

In many coastal localities, other more pressing concerns appear to create obstacles to the enactment of specific programs or policies for hazard mitigation. In these cases, effectiveness in enacting mitigation programs may be increased by combining hazard reduction policies with other community objectives. Case studies conducted of hurricane-prone communities indicated that hazard-reducing development management policies which were locally initiated were supported for a number of community goals. Related local issues that may garner broader support include desire for open space, public beach access, concern over aesthetics, and worry over water quality and other environmental impacts of development. Emphasizing the multiple community benefits that result from prudent hazard-reducing development management measures will help to overcome the existing obstacles to development management that still persist in many communities.

References

Beatley, Timothy, et al.
1985 Storm Hazard Reduction Through Development Management: Results of a Survey of Hurricane-prone Localities in Nineteen Coastal States. Chapel Hill, NC: University of North Carolina, Center for Urban and Regional Studies.

Brower, David, et al.
1984 Managing Development in Small Towns. Chicago: APA Planners Press.

David, E., and J. Mayer
1984 "Comparing Costs of Alternative Flood Hazard Mitigation Plans." Journal of the American Planning Association 50 (winter): 22-35.

Kusler, J. A.
1982 Regulation of Flood Hazard Areas to Reduce Flood Losses: Volume 3. Boulder: Natural Hazards Research and Applications Information Center.

McElyea, W., D. Brower, and D. Godschalk
1982 Before the Storm: Managing Development to Reduce Hurricane Damages. Chapel Hill, NC: University of North Carolina, Center for Urban and Regional Studies.